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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/539,624	06/17/2005	Naoya Matsuoka	050340-0190	4578

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EXAMINER	
HAN, KWANG S	

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1795	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/539,624	MATSUOKA, NAOYA	
	Examiner	**Art Unit**	
	Kwang Han	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-15_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-15_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _17 June 2005_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _6/17/05 and 11/13/07_.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Specification

2. This application does not contain an abstract of the disclosure as required by 37 CFR 1.72(b). An abstract on a separate sheet is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. <u>Claims 1, 2, 6, 7, 9, 11, and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mathias et al. (US 6376111, as cited in IDS) in view of Busenbender (US 2003/0039870) and Suzuki et al. (US 2001/0010872).</u>

Regarding claim 1, Mathias discloses a fuel cell system comprised of the following:

- an anode (18) which contacts the fuel gas (Column 2, Lines 30-31) ,
- a cathode (16) which contacts the oxidant gas (Column 2, Lines 28-30),
- an electrolyte membrane (14) held between the anode and cathode (Figure 1),
- a moisture adjusted gas generating mechanism (Column 2, Line 54 – Column 3, Line 7), and
- a programmable controller (44) (Column 4, Lines 7-9).

Mathias discloses the measurement of resistance within the fuel cell assembly to determine the humidity level within the system (Column 3, Lines 42-46) but is silent towards the measurement of temperature to control the humidity within the fuel cell and also determine a target humidity based on a temperature of the fuel cells after power generation is halted.

Busenbender teaches a sensor which detects the fuel cell temperature to send a temperature-based control signal to a control system [0014] as part of a system for the benefit of avoiding of freezing water present in a fuel cell during periods of inactivity [Abstract].

Suzuki et al. teaches a control system [0033] which directs dry air to remove residual moisture, and thereby changing the humidity level, in a fuel cell system to prevent freezing [0043, 0048].

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply Busenbender's temperature sensor for the fuel cell and Suzuki's controlled modification of the humidity level to a target humidity within Mathias' fuel cell anode or cathode for the benefit of preventing freezing during low temperature when the fuel cell is halted.

Regarding claim 2, Mathias discloses a moisture adjusted gas comprised of humidified fuel gas and humidified oxidant gas (Column 2, Lines 54-59).

Regarding claim 6, Mathias discloses a fuel cell system which comprises a sensor (42) which detects a wet condition of the fuel cell and the controller (44) is programmed to set the target humidity higher when the wet condition of the fuel cell is drier than a predetermined level of a membrane wet region (Column 4, Lines 1-18).

Regarding claim 7, Mathias discloses a controller further programmed to modify the target humidity according to the wet condition of the fuel cell which varies during the supply of moisture-adjusted gas and to control the gas generating mechanism such that the humidity of the moisture adjusted gas matches the modified target humidity (Column 4, Lines 1-18).

Regarding claim 9, Mathias discloses a sensor (42) which measures electrical resistance between the anode and the cathode (Column 3, Lines 42-46).

Regarding claim 11, the teachings of Mathias, Busenbender, and Suzuki as discussed above are herein incorporated. Mathias discloses a sensor which measures the humidity within the fuel cell but is silent towards a sensor to measure the outside temperature.

Busenbender teaches a sensor to measure the outside temperature (122) which is used to provide a signal to the controller to determine when a threshold temperature value has been reached [0037] during periods of system inactivity [Abstract] to avoid freezing of water resident in the system.

Suzuki teaches a sensor to measure the outer temperature used to initiate a mode to stop freezing within the fuel cell once reaching a critical temperature [0043, 0048].

It would have been obvious to one of ordinary skill in the art at the time of the invention to use Busenbender or Suzuki's sensor in Mathias' fuel cell to provide a means to control the moisture-adjusted gas during low temperatures when the fuel cell has been halted to stop freezing within the fuel cells.

Regarding claim 12, Mathias discloses a target humidity during testing for the cathode at 50% relative humidity (Column 5, Line 38-40) and for the anode at 73% relative humidity (Column 5, Lines 49-50). Mathias also teaches that the efficiency of a fuel cell is a function of the humidification (Column 6, Lines 5-8; Column 5, Lines 38-58).

It would have been obvious to one of ordinary skill in the art at the time of the invention to set the target humidity between 15% and 95% since it has been held that discovering the optimum ranges for a result effective variable such as the target humidity for a fuel cell involves only routine skill in the art in the absence of showing of criticality in the claimed range (MPEP 2144.05).

6. Claims 3, 4, and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mathias et al., Busenbender, and Suzuki et al. as applied to claim 1 above, and further in view of Nonobe (US 6524733).

Regarding claim 3, the teachings of Mathias, Busenbender, and Suzuki at discussed above are herein incorporated. Mathias teaches the humidifier can humidify one or both of the cathode and anode flow channels and the humidifier may be external or comprise a section of the fuel cell (Column 2, Lines 56-64). Busenbender and Suzuki are silent as to having a first and second humidifier.

Nonobe teaches a fuel cell with a humidity control system which uses a fuel gas humidifier (23) and an oxidative gas humidifier (25) to selectively control the humidification levels in both gas channels to stay within a proper range [Abstract].

It would have been obvious to one of ordinary skill in the art at the time of the invention to use Nonobe's first and second humidifier in the fuel cell of Mathias as modified by Busenbender and Suzuki to maintain a specific adjusted humidity for both gas channels to maintain efficiency or prevent freezing.

Regarding claim 4, Mathias and Busenbender are silent towards having a difference in humidity relative to temperature. Suzuki discloses minimizing humidity as temperature decreases as discussed above but is silent towards increasing humidity with greater temperature.

Nonobe teaches that with higher degrees of humidity the operating temperatures of the fuel cell need to be higher to have higher vapor pressures (Column 7, Lines 32-38) to maintain vaporization of water.

It would have been obvious to one of ordinary skill in the art at the time of the invention to set the target humidity higher as taught by Nonobe's increased fuel cell temperature during higher humidity levels in the fuel cell of Mathias as modified by Busenbender and Suzuki for the benefit of increasing the vapor pressure of the fuel cell to maintain vaporization of water to prevent flooding of the fuel cell.

Regarding claim 8, the teachings of Mathias, Busenbender, and Suzuki as discussed above are herein incorporated.

Mathias discloses a controller programmed to control the moisture-adjusted gas when the wet condition of the fuel cell has reached a predetermined state of equilibrium (Column 4, Lines 45-50).

Nonobe teaches a controller (60) which controls the moisture-adjusted gas generating mechanism (23, 24) based on the temperature of the fuel cell and wet conditions of the fuel cell (Column 5, Lines 50-64) and halts the supply of moisture-adjusted gas as required (Column 7, Lines 5-14) to increase efficiency of the fuel cell.

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply Nonobe's controller in the fuel cell of Mathias as modified by Busenbender, and Suzuki for the benefit of providing halting of moisture-adjusted gas as the temperature and wet conditions of the fuel cell to meet conditions for the greatest efficiency of the fuel cell.

7. Claim 5 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mathias et al., Busenbender and Suzuki et al. as applied to claim 1 above, and further in view of Sugiura (JP 2003-022831, online translation).

Regarding claim 5, the teachings of Mathias, Busenbender, and Suzuki as discussed above are herein incorporated. Mathias discloses a controller which halts the supply of moisture-adjusted gas determined by the humidity range within the fuel cell (Column 4, Lines 1-18). Busenbender and Suzuki are silent towards stopping a supply of moisture-adjusted gas after a period of time.

Sugiura teaches halting the supply of a moisture-adjusted gas after a specified time after the operation of a fuel cell is stopped to prevent the deterioration of a separator [Abstract].

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply Sugiura's halting of moisture-adjusted gas after a specified period of time in the fuel cell of Mathias as modified by Busenbender, and Suzuki for the benefit of preventing deterioration to the separator.

Regarding claim 13, the teachings of Mathias, Busenbender, and Suzuki as discussed above are herein incorporated. Mathias, Busenbender, and Suzuki are silent towards the controller being programmed to set the target humidity higher for the anode than the cathode after the fuel cell is halted.

Sugiura teaches the supply of a moisture adjusted gas is for the anode gas channel for the purpose of flushing acid eluted from the MEA during fuel cell operation to prevent deterioration of the separator [0005].

It would have been obvious to one of ordinary skill in the art at the time of the invention to set a higher target humidity for the anode as taught by Sugiura in the fuel cell of Mathias as modified by Busenbender, and Suzuki for the benefit of flushing out eluted acids from the fuel cell to prevent deterioration of the separator.

8. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mathias et al., Busenbender, and Suzuki et al. as applied to claim 1 above, and further in view of Ban et al. (US 6350536) and Gilbert (US 2003/0170506).

Regarding claim 10, the teachings of Mathias, Busenbender, and Suzuki as discussed above are herein incorporated. Mathias further discloses a fuel cell stack (Column 2, Lines 63-64) and an inlet and an outlet to the membrane electrode assembly (Figure1) with a sensor but is silent towards having a first and second sensor at the inlet and outlet respectively.

Ban et al. teaches a humidity sensor (23) placed at the inlet of the fuel cell to detect the wet condition of the processed air at the vicinity of the inlet of the fuel cell to provide a detection signal for when the compressor can be stopped (Column 4, lines 9-14).

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply Ban inlet placement of the humidity sensors in the fuel cell of Mathias as modified by Busenbender, and Suzuki for the benefit of knowing when a target humidity has been reached at the inlet of the fuel cell.

Gilbert teaches a humidity sensor placed (48) at the outlet of the fuel cell to detect the wet condition of the exhaust gases at the vicinity of the outlet of the fuel cell [0017, 0018] to gauge the operating conditions of the fuel cell.

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply Gilbert's outlet sensor in the fuel cell of Mathias as modified by Busenbender, and Suzuki for the benefit of gauging the operating conditions of the fuel cell.

It would further have been obvious to one of ordinary skill in the art at the time of the invention to apply Gilbert's outlet placement of the humidity sensors in combination with the inlet humidity sensor of Ban and further in combination with the controller for the fuel cell of Mathias as modified by Busenbender, and Suzuki for the benefit of knowing when to stop the supply of moisture-adjusted gas as determined by the inlet and out sensors to know when the target humidity has been reached and to know the operating conditions of the fuel cell.

9. <u>Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mathias et al. and further in view of Nonobe and Sugiura.</u>

Regarding claim 14, Mathias is directed towards a fuel cell system comprised of the following:

- performs power generation by means of an electrochemical reaction of a fuel gas and an oxidant gas (Column 1, Lines 17-20),
- an anode (18) which contacts the fuel gas (Column 2, Lines 30-31) ,
- a cathode (16) which contacts the oxidant gas (Column 2, Lines 28-30),

- an electrolyte membrane (14) held between the anode and cathode (Figure 1), and
- a means for generating moisture-adjusted gas at an arbitrary humidity (Column 2, Line 54 – Column 3, Line 7).

Nonobe teaches a controller (60) which controls the moisture-adjusted gas generating mechanism (23, 24) to provide a target humidity based on the temperature of the fuel cell and wet conditions of the fuel cell (Column 5, Lines 50-64) and halts the supply of moisture-adjusted gas as required (Column 7, Lines 5-14) to increase efficiency of the fuel cell.

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply Nonobe's controller in Mathias' fuel cell for the benefit of providing a target humidity based on the temperature and wet conditions of the fuel cell to provide optimum conditions for efficiency or freezing concerns.

Sugiura teaches supply of a moisture-adjusted gas and halting after a specified time after the operation of a fuel cell is stopped [Abstract] so that the supply of a moisture-adjusted gas can serve the purpose of flushing acid eluted from the MEA during fuel cell operation to prevent deterioration of the separator [0005].

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply Sugiura's supply of a moisture adjusted gas to the fuel cell of Mathias as modified by Nonobe to provide the target humidity after power generation has halted to prevent deterioration to the fuel cell.

10. <u>Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mathias et al. and further in view of Nonobe and Sugiura.</u>

Regarding claim 15, the teachings of Mathias, Nonobe, and Suguira as discussed above are herein incorporated. Mathias is directed towards a fuel cell system comprised of the following:

- performs power generation by means of an electrochemical reaction of a fuel gas and an oxidant gas (Column 1, Lines 17-20),
- an anode (18) which contacts the fuel gas (Column 2, Lines 30-31) ,
- a cathode (16) which contacts the oxidant gas (Column 2, Lines 28-30),
- an electrolyte membrane (14) held between the anode and cathode (Figure 1),
- a moisture adjusted gas generating mechanism for generating moisture-adjusted gas at an arbitrary humidity (Column 2, Line 54 – Column 3, Line 7), and
- controlling the gas generating mechanism to supply moisture-adjusted gas to at least one of the anode and cathode (Column 1, Lines 46-52; Column 2, Lines 54-59).

Mathias is silent towards providing moisture adjusted gas at a target humidity after power generation is halted.

Nonobe teaches a controller (60) which controls the moisture-adjusted gas generating mechanism (23, 24) to provide a target humidity based on the temperature of the fuel cell and wet conditions of the fuel cell (Column 5, Lines 50-64) and halts the

supply of moisture-adjusted gas as required (Column 7, Lines 5-14) to increase efficiency of the fuel cell.

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply Nonobe's controller in Mathias' fuel cell for the benefit of determining a target humidity based on the temperature and wet conditions of the fuel cell to provide optimum conditions for efficiency or freezing concerns.

Sugiura teaches supply of a moisture-adjusted gas and halting after a specified time after the operation of a fuel cell is stopped [Abstract] so that the supply of a moisture-adjusted gas can serve the purpose of flushing acid eluted from the MEA during fuel cell operation to prevent deterioration of the separator [0005].

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply Sugiura's supply of a moisture adjusted gas to the fuel cell of Mathias as modified by Nonobe to provide the target humidity after power generation has halted to prevent deterioration to the fuel cell.

Contact/Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kwang Han whose telephone number is (571) 270-5264. The examiner can normally be reached on Monday through Friday 8:00am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Susy Tsang-Foster can be reached on (571) 272-1293. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/K. H./
Examiner, Art Unit 1795

/Susy Tsang-Foster/
Supervisory Patent Examiner, Art Unit 1795